

HR-175 Macadam Stone Base

Key Words: Macadam stone, Subbase

ABSTRACT

The need for a less expensive road base construction method is very apparent, especially to the county engineer faced with maintaining quality lower traffic volume farm-to-market roads. The revival of the Macadam stone base is one possible solution. Des Moines County believed a Macadam road had excellent possibilities for their particular needs. They proposed a research project designed to eliminate some of the unknown factors of Macadam stone base construction. It is the intent of this research project to develop standardized design procedures and serve as an aid for others in constructing a Macadam base roadway. The Iowa Department of Transportation has published special provisions for the construction of Macadam stone bases that were adopted as the guideline specifications for the research project.

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The proposed research in Des Moines County involves the construction of the experimental Macadam stone base, which is composed of one or more compacted layers of large stone particles having a maximum size of four inches and a minimum size of one inch. A layer of smaller size stone having a maximum size of one inch is then placed on top of the larger stone and compacted into the openings between the larger stone. The result is a firm stable crushed stone base with a chokestone layer on top. The surface for the project is to be a double application of asphalt-aggregate seal coat.

Side view of 4" stone and chokestone The experimental features include variations in the thickness of the Macadam base from 4 inches to 10 inches with 2 inches of chokestone, variation in the placement and type of lateral drainage systems and alternating sections of Macadam or earth shoulder construction. An additional experimental feature is provided by the existence of two slightly different types of soil having different support and drainage characteristics

The main objectives of the research project are to seek a more economical method for road construction employing crushed stone and to investigate methods for providing lateral drainage. Other objectives of the project are:

- To determine the best method for construction and volume production of crushed stone
- To evaluate the performance over a period of time
- To evaluate the usage of marginal crushed stone abrasion not to exceed 50
- To consider the energy conservation
- To compare economic factors.

Des Moines County has kept a close watch on the road and it has surpassed their expectations. The objectives as stated have been met. The lateral drainage systems are working. Efficient construction methods have been found. The marginal crushed limestone aggregate is performing satisfactorily. A small amount of equipment was needed for the construction, thus conserving energy. The project resulted in high economical use of the aggregate and most importantly, the Macadam base road has performed favorably with concrete and asphalt roads costing over twice as much to build. The average cost per mile of the 9.003 mile Des Moines County Macadam road was \$44,998.02. For the research project standpoint, the Macadam project was very successful and didn't have many of the problems usually associated with research projects.

The research project has shown that the aggregate used in Macadam construction does not have to be of the highest quality. The marginal limestone used in Des Moines County is serving quite adequately. The slightly elongated shape of the 4" stone used in the base appears to enhance a strong interlock when compacted. Although only 4" stone was used in this project, further research on the use of 6" stone is recommended. Even though the 2" chokestone layer is performing satisfactory and was an efficient construction method, research on the use of a thin asphalt mat wearing surface placed directly on top of the Macadam base is recommended. In order to improve the load bearing ability of the road structure and also reduce the amount of aggregate used for the chokestone, it is recommended that an open grade asphalt mix be used. This "popcorn mix" will seal off the Macadam stone base. A 1-2" mat should be placed on top of the "popcorn" layer. The lateral trench drains are serving effectively to eliminate any excess moisture in the base and subgrade. Although not sufficient information has been collected or observed to compare the performance of the two different types of porous backfill, the 2" gravel is the recommended material. The construction methods and equipment used during the research project work efficiently. The use of a D-8 or larger caterpillar on the Jersey Spreader is advisable. The larger Caterpillars do a much more uniform and even spread of the Macadam stone resulting in the need for less blading. Some segregation was experienced in sections where it took several motor patrol passes to level the stone. It was felt that an electronically controlled motor patrol could improve the riding quality of the road.

Conservation of material and energy resulted in a very economical project. All fractions of the crushed limestone could be used in the construction. Also, a small amount of equipment was needed during the construction period of 50 work days.